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Silver and gold luminescent metallomesogens based on pyrazole ligands

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SUPPLEMENTARY INFORMATION

Preparation of the complexes type I: $[\text{Ag}(\text{Hpz}^{2R(n)})_2][\text{A}]$ ($R = \text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$, $n = 12, 14, 16, 18$; $\text{A} = \text{BF}_4^- \text{I}_{\text{BF}4}$ (1-4), $\text{PF}_6^- \text{I}_{\text{PF}6}$ (5-8), $\text{NO}_3^- \text{I}_{\text{NO}3}$ (9-12)).

To a solution of the corresponding 3,5-bis(4-alkyloxyphenyl)-1*H*-pyrazole ($\text{Hpz}^{2R(n)}$) in dry tetrahydrofuran was added AgA in a 2:1 molecular ratio under dinitrogen atmosphere. The mixture was stirred for 24 hours in absence of light, and then filtered through Celite. The clear filtrate was removed *in vacuo* and the residue was dissolved in dichloromethane. Addition of hexane gave rise to a colorless solid, which was filtered off, washed with hexane and dried *in vacuo*. Spectroscopic data are given for **1**, **5** and **9**. Data for the other homologues are essentially identical.

$[\text{Ag}(\text{Hpz}^{2R(12)})_2][\text{BF}_4]$ (**1**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3223m (NH), 1615m (C=N) + (C=C), 1026s (BF). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.88 (12 H, t, $^3J_{\text{H,H}}$ 6.5, CH_3), 1.27 (72 H, m, CH_2), 1.80 (8 H, m, CH_2), 3.96 (8 H, t, $^3J_{\text{H,H}}$ 6.3, OCH_2), 6.67 (2 H, s, C(4)H), 6.88 (8 H, d, $^3J_{\text{H,H}}$ 8.5, H_m), 7.60 (8 H, d, $^3J_{\text{H,H}}$ 8.5, H_o).

$[\text{Ag}(\text{Hpz}^{2R(12)})_2][\text{PF}_6]$ (**5**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3395m (NH), 1615m (C=N) + (C=C), 838vs (PF). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.88 (12 H, t, $^3J_{\text{H,H}}$ 6.6, CH_3), 1.25 (72 H, m, CH_2), 1.80 (8 H, m, $^3J_{\text{H,H}}$ 6.8, CH_2), 3.96 (8 H, t, $^3J_{\text{H,H}}$ 6.3, OCH_2), 6.68 (2 H, s, C(4)H), 6.87 (8 H, d, $^3J_{\text{H,H}}$ 8.5, H_m), 7.60 (8 H, d, $^3J_{\text{H,H}}$ 8.5, H_o).

$[\text{Ag}(\text{Hpz}^{2R(12)})_2][\text{NO}_3]$ (**9**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3223m (NH), 1615m (C=N) + (C=C), 1388m (NO). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.88 (12 H, t, $^3J_{\text{H,H}}$ 6.8, CH_3), 1.27 (72 H, m, CH_2), 1.81 (8 H, m, $^3J_{\text{H,H}}$ 7.0, CH_2), 3.99 (8 H, t, $^3J_{\text{H,H}}$ 6.6, OCH_2), 6.70 (2 H, s, C(4)H), 6.92 (8 H, d, $^3J_{\text{H,H}}$ 8.6, H_m), 7.69 (8 H, d, $^3J_{\text{H,H}}$ 8.6, H_o).

Preparation of the complexes type II: $[\text{Au}(\text{Hpz}^{2R(n)})_2][\text{A}]$ ($R = \text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$, $n = 12, 14$; $\text{A} = \text{BF}_4^- \text{I}_{\text{BF}4}$ (13, 14), $\text{PF}_6^- \text{I}_{\text{PF}6}$ (15, 16), $\text{NO}_3^- \text{I}_{\text{NO}3}$ (17, 18)).

To a mixture of AgA and [AuCl(tht)] in dry tetrahydrofuran was added a solution of the corresponding 3,5-bis(4-alkyloxyphenyl)-1*H*-pyrazole (Hpz^{2R(n)}) in a 1:1:2 molecular ratio under dinitrogen atmosphere. The mixture was stirred for 24 hours in absence of light, and then filtered through Celite. The clear filtrate was removed *in vacuo* and the residue was dissolved in dichloromethane. Addition of hexane gave rise to a colorless solid, which was filtered off, washed with hexane and dried *in vacuo*. Spectroscopic data are given for **13**, **15** and **17**. Data for the other homologues are essentially identical.

[Au(Hpz^{2R(12)})₂][BF₄] (**13**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3246m (NH), 1580m (C=N) + (C=C), 1041s (BF). δ_H (300 MHz; CDCl₃; Me₄Si) 0.88 (12 H, t, ³J_{H,H} 6.2, CH₃), 1.28 (72 H, m, CH₂), 1.82 (8 H, m, ³J_{H,H} 6.2, CH₂), 3.96 (4 H, t, ³J_{H,H} 6.2, OCH₂), 4.00 (4 H, t, ³J_{H,H} 6.7, OCH₂), 6.74 (2 H, s, C(4)H), 6.79 (4 H, d, ³J_{H,H} 8.8, H_m), 7.01 (4 H, d, ³J_{H,H} 8.4, H_m), 7.69 (4 H, d, ³J_{H,H} 8.8, H_o), 7.71 (4 H, d, ³J_{H,H} 8.4, H_o), 12.49 (2 H, s, NH).

[Au(Hpz^{2R(12)})₂][PF₆] (**15**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3390m (NH), 1626m (C=N) + (C=C), 836vs (PF). δ_H (300 MHz; CDCl₃; Me₄Si) 0.88 (12 H, t, ³J_{H,H} 7.0, CH₃), 1.28 (72 H, m, CH₂), 1.81 (8 H, m, CH₂), 3.93 (8 H, t, ³J_{H,H} 6.4, OCH₂), 6.70 (2 H, s, C(4)H), 6.75 (4 H, d, ³J_{H,H} 8.8, H_m), 7.0 (4 H, d, ³J_{H,H} 8.8, H_m), 7.75 (4 H, d, ³J_{H,H} 8.8, H_o), 7.79 (4 H, d, ³J_{H,H} 8.8, H_o), 13.85 (2 H, s, NH).

[Au(Hpz^{2R(12)})₂][NO₃] (**17**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3230m (NH), 1615m (C=N) + (C=C), 1385m (NO). δ_H (300 MHz; CDCl₃; Me₄Si) 0.88 (12 H, t, ³J_{H,H} 6.8, CH₃), 1.27 (72 H, m, CH₂), 1.81 (8 H, m, CH₂), 3.97 (4 H, t, ³J_{H,H} 6.2, OCH₂), 4.00 (4 H, t, ³J_{H,H} 6.1, OCH₂), 6.74 (2 H, s, C(4)H), 6.81 (4 H, d, ³J_{H,H} 8.7, H_m), 7.01 (4 H, d, ³J_{H,H} 8.1, H_m), 7.75 (4 H, d, ³J_{H,H} 8.7, H_o), 7.79 (4 H, d, ³J_{H,H} 8.1, H_o), 13.85 (2 H, s, NH).

Preparation of the complexes type III: $[\text{Ag}(\text{Hpz}^{\text{R}(n)})_2][\text{A}]$ ($\text{R} = \text{C}_6\text{H}_4\text{OC}_n\text{H}_{2n+1}$, $n = 4, 12, 14, 16, 18$; $\text{A} = \text{BF}_4^-$ III_{BF4} (19-22), PF_6^- III_{PF6} (23-27), NO_3^- III_{NO3} (28-31)).

To a solution of the corresponding 3-(4-alkyloxyphenyl)-1*H*-pyrazole ($\text{Hpz}^{\text{R}(n)}$) in dry tetrahydrofuran was added AgA in a 2:1 molecular ratio under dinitrogen atmosphere. The mixture was stirred for 24 hours in absence of light, and then filtered through Celite. The clear filtrate was removed *in vacuo* and the residue was dissolved in dichloromethane. Addition of hexane gave rise to a colorless solid, which was filtered off, washed with hexane and dried *in vacuo*. Spectroscopic data are given for **19**, **23**, **24** and **28**. Data for the other homologues are essentially identical.

$[\text{Ag}(\text{Hpz}^{\text{R}(12)})_2][\text{BF}_4]$ (**19**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3231m (NH), 1618m (C=N) + (C=C), 1032s (BF). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.87 (6 H, t, ${}^3J_{\text{H},\text{H}}$ 6.8, CH_3), 1.25 (36 H, m, CH_2), 1.80 (4 H, m, ${}^3J_{\text{H},\text{H}}$ 6.8, CH_2), 3.99 (4 H, t, ${}^3J_{\text{H},\text{H}}$ 6.6, OCH_2), 6.57 (2 H, d, ${}^3J_{\text{H},\text{H}}$ 2.2, C(4)H), 6.94 (4 H, d, ${}^3J_{\text{H},\text{H}}$ 8.8, H_m), 7.64 (2 H, br, C(5)H), 7.66 (4 H, d, ${}^3J_{\text{H},\text{H}}$ 8.8, H_o).

$[\text{Ag}(\text{Hpz}^{\text{R}(4)})_2][\text{PF}_6]$ (**23**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3370m (NH), 1617m (C=N) + (C=C), 831vs (PF). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.99 (6 H, t, ${}^3J_{\text{H},\text{H}}$ 7.2, CH_3), 1.48 (4 H, m, ${}^3J_{\text{H},\text{H}}$ 6.9, CH_2), 1.79 (4 H, m, ${}^3J_{\text{H},\text{H}}$ 6.9, CH_2), 3.98 (4 H, t, ${}^3J_{\text{H},\text{H}}$ 6.4, OCH_2), 6.55 (2 H, d, ${}^3J_{\text{H},\text{H}}$ 2.3, C(4)H), 6.94 (4 H, d, ${}^3J_{\text{H},\text{H}}$ 8.3, H_m), 7.61 (2 H, br, C(5)H), 7.62 (4 H, d, ${}^3J_{\text{H},\text{H}}$ 8.3, H_o).

$[\text{Ag}(\text{Hpz}^{\text{R}(12)})_2][\text{PF}_6]$ (**24**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3377m (NH), 1616m (C=N) + (C=C), 852vs (PF). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.88 (6 H, t, ${}^3J_{\text{H},\text{H}}$ 6.6, CH_3), 1.27 (36 H, m, CH_2), 1.81 (4 H, m, ${}^3J_{\text{H},\text{H}}$ 6.3, CH_2), 3.98 (4 H, t, ${}^3J_{\text{H},\text{H}}$ 6.1, OCH_2), 6.56 (2 H, br, C(4)H), 6.94 (4 H, d, ${}^3J_{\text{H},\text{H}}$ 8.3, H_m), 7.57 (4 H, d, ${}^3J_{\text{H},\text{H}}$ 8.3, H_o), 7.65 (2 H, br, C(5)H).

$[\text{Ag}(\text{Hpz}^{\text{R}(12)})_2][\text{NO}_3]$ (**28**). $\nu_{\text{max}}/\text{cm}^{-1}$ 3246m (NH), 1614m (C=N) + (C=C), 1380m (NO). δ_H (300 MHz; CDCl_3 ; Me_4Si) 0.89 (6 H, t, ${}^3J_{\text{H},\text{H}}$ 6.6, CH_3), 1.28 (36 H, m, CH_2),

1.81 (4 H, m, $^3J_{H,H}$ 6.6, CH₂), 3.99 (4 H, t, $^3J_{H,H}$ 6.6, OCH₂), 6.55 (2 H, d, $^3J_{H,H}$ 1.9, C(4)H), 6.94 (4 H, d, $^3J_{H,H}$ 8.8, H_m), 7.64 (2 H, br, C(5)H), 7.66 (4 H, d, $^3J_{H,H}$ 8.8, H_o).

Preparation of the complexes type IV: [Au(Hpz^{R(n)})₂][A] (R = C₆H₄OC_nH_{2n+1}, n = 12, 14; A = BF₄⁻ IV_{BF4} (33, 34), PF₆⁻ IV_{PF6} (35, 36), NO₃⁻ IV_{NO3} (37, 38)).

To a mixture of AgA and [AuCl(tht)] in dry tetrahydrofuran was added a solution of the corresponding 3-(4-alkyloxyphenyl)-1*H*-pyrazole (Hpz^{R(n)}) in a 1:1:2 molecular ratio under dinitrogen atmosphere. The mixture was stirred for 24 hours in absence of light, and then filtered through Celite. The clear filtrate was removed *in vacuo* and the residue was dissolved in dichloromethane. Addition of hexane gave rise to a colorless solid, which was filtered off, washed with hexane and dried *in vacuo*. Spectroscopic data are given for 33, 35 and 37. Data for the other homologues are essentially identical.

[Au(Hpz^{R(12)})₂][BF₄] (33). $\nu_{\text{max}}/\text{cm}^{-1}$ 3247m (NH), 1581m (C=N) + (C=C), 1030s (BF). δ_H (300 MHz; CDCl₃; Me₄Si) 0.88 (6 H, t, $^3J_{H,H}$ 7.3, CH₃), 1.27 (36 H, m, CH₂), 1.80 (4 H, m, $^3J_{H,H}$ 7.3, CH₂), 3.99 (4 H, t, $^3J_{H,H}$ 6.4, OCH₂), 6.70 (2 H, br, C(4)H), 6.99 (4 H, d, $^3J_{H,H}$ 8.1, H_m), 7.72 (4 H, d, $^3J_{H,H}$ 8.1, H_o), 7.89 (2 H, br, C(5)H).

[Au(Hpz^{R(12)})₂][PF₆] (35). $\nu_{\text{max}}/\text{cm}^{-1}$ 3354m (NH), 1617m (C=N) + (C=C), 836vs (PF). δ_H (300 MHz; CDCl₃; Me₄Si) 0.88 (6 H, t, $^3J_{H,H}$ 6.7, CH₃), 1.26 (36 H, m, CH₂), 1.80 (4 H, m, $^3J_{H,H}$ 7.8, CH₂), 3.97 (4 H, t, $^3J_{H,H}$ 6.6, OCH₂), 6.64 (2 H, br, C(4)H), 6.99 (4 H, d, $^3J_{H,H}$ 8.7, H_m), 7.62 (4 H, d, $^3J_{H,H}$ 8.7, H_o), 7.84 (2 H, br, C(5)H).

[Au(Hpz^{R(12)})₂][NO₃] (37). $\nu_{\text{max}}/\text{cm}^{-1}$ 3230m (NH), 1579m (C=N) + (C=C), 1380m (NO). δ_H (300 MHz; CDCl₃; Me₄Si) 0.88 (6 H, t, $^3J_{H,H}$ 7.1, CH₃), 1.27 (36, m, CH₂), 1.80 (4 H, m, $^3J_{H,H}$ 7.7, CH₂), 3.99 (4 H, t, $^3J_{H,H}$ 6.4, OCH₂), 6.74 (2 H, br, C(4)H), 6.96 (4 H, d, $^3J_{H,H}$ 7.7, H_m), 7.65 (4 H, d, $^3J_{H,H}$ 7.6, H_o), 7.81 (2 H, br, C(5)H).

Table S1. Yields and analytical data of the compounds

| COMPLEX | MOLECULAR FORMULA | Yield(%) | molecular weight (g mol ⁻¹) | Elemental analysis | | | | | |
|--------------------------|--|----------|--|--------------------|------|-----|------------------|-----|-----|
| | | | | calculated (%) | | | experimental (%) | | |
| | | | | C | H | N | C | H | N |
| I_{BF4} | 1 C ₇₈ H ₁₂₀ N ₄ O ₄ AgBF ₄ | 55 | 1372.5 | 68.3 | 8.8 | 4.1 | 68.3 | 8.6 | 4.1 |
| | 2 C ₈₆ H ₁₃₆ N ₄ O ₄ AgBF ₄ | 56 | 1484.7 | 69.6 | 9.2 | 3.8 | 69.9 | 9.3 | 3.5 |
| | 3 C ₉₄ H ₁₅₂ N ₄ O ₄ AgBF ₄ | 65 | 1596.0 | 70.7 | 9.6 | 3.5 | 70.4 | 9.4 | 3.4 |
| | 4 C ₁₀₂ H ₁₆₈ N ₄ O ₄ AgBF ₄ | 68 | 1709.0 | 71.7 | 9.9 | 3.3 | 71.5 | 9.6 | 3.2 |
| I_{PF6} | 5 C ₇₈ H ₁₂₀ N ₄ O ₄ AgPF ₆ | 53 | 1430.7 | 65.5 | 8.4 | 3.9 | 65.6 | 8.1 | 3.9 |
| | 6 C ₈₆ H ₁₃₆ N ₄ O ₄ AgPF ₆ | 56 | 1542.9 | 66.9 | 8.9 | 3.6 | 66.8 | 8.6 | 3.6 |
| | 7 C ₉₄ H ₁₅₂ N ₄ O ₄ AgPF ₆ | 50 | 1655.1 | 68.2 | 9.3 | 3.4 | 68.0 | 9.3 | 3.3 |
| | 8 C ₁₀₂ H ₁₆₈ N ₄ O ₄ AgPF ₆ | 54 | 1767.3 | 69.3 | 9.6 | 3.2 | 69.5 | 9.3 | 3.2 |
| I_{NO3} | 9 C ₇₈ H ₁₂₀ N ₄ O ₄ AgNO ₃ | 53 | 1347.7 | 69.5 | 9.0 | 5.2 | 69.4 | 8.8 | 5.0 |
| | 10 C ₈₆ H ₁₃₆ N ₄ O ₄ AgNO ₃ | 56 | 1459.9 | 70.7 | 9.4 | 4.8 | 70.5 | 9.2 | 4.8 |
| | 11 C ₉₄ H ₁₅₂ N ₄ O ₄ AgNO ₃ | 51 | 1572.2 | 71.8 | 9.8 | 4.4 | 72.0 | 9.6 | 4.2 |
| | 12 C ₁₀₂ H ₁₆₈ N ₄ O ₄ AgNO ₃ | 55 | 1684.4 | 72.7 | 10.0 | 4.2 | 72.4 | 9.6 | 4.2 |
| II_{BF4} | 13 C ₇₈ H ₁₂₀ N ₄ O ₄ AuBF ₄ | 48 | 1461.6 | 64.1 | 8.3 | 3.8 | 64.5 | 8.4 | 3.6 |
| | 14 C ₈₆ H ₁₃₆ N ₄ O ₄ AuBF ₄ | 50 | 1573.8 | 65.6 | 8.7 | 3.6 | 65.8 | 8.6 | 3.3 |
| II_{PF6} | 15 C ₇₈ H ₁₂₀ N ₄ O ₄ AuPF ₆ | 56 | 1519.8 | 61.6 | 8.0 | 3.7 | 61.3 | 7.7 | 3.4 |
| | 16 C ₈₆ H ₁₃₆ N ₄ O ₄ AuPF ₆ | 54 | 1632.0 | 63.3 | 8.4 | 3.4 | 63.6 | 8.7 | 3.3 |
| II_{NO3} | 17 C ₇₈ H ₁₂₀ N ₄ O ₄ AuNO ₃ | 60 | 1436.8 | 65.2 | 8.4 | 4.9 | 65.1 | 8.2 | 4.7 |
| | 18 C ₈₆ H ₁₃₆ N ₄ O ₄ AuNO ₃ | 61 | 1549.0 | 66.7 | 8.8 | 4.5 | 66.3 | 8.7 | 4.8 |
| III_{BF4} | 19 C ₄₂ H ₆₄ N ₄ O ₂ AgBF ₄ | 51 | 851.7 | 59.2 | 7.6 | 6.6 | 59.4 | 7.4 | 6.5 |
| | 20 C ₄₆ H ₇₂ N ₄ O ₂ AgBF ₄ | 56 | 907.8 | 60.9 | 8.0 | 6.2 | 60.9 | 8.1 | 6.1 |
| | 21 C ₅₀ H ₈₀ N ₄ O ₂ AgBF ₄ | 60 | 963.9 | 62.3 | 8.4 | 5.8 | 62.0 | 8.3 | 5.6 |
| | 22 C ₅₄ H ₈₈ N ₄ O ₂ AgBF ₄ | 62 | 1020.0 | 63.6 | 8.7 | 5.5 | 63.6 | 8.4 | 5.3 |
| III_{PF6} | 23 C ₂₆ H ₃₂ N ₄ O ₂ AgPF ₆ | 68 | 685.4 | 45.6 | 4.7 | 8.2 | 45.6 | 4.6 | 8.2 |
| | 24 C ₄₂ H ₆₄ N ₄ O ₂ AgPF ₆ | 57 | 909.8 | 55.4 | 7.1 | 6.2 | 55.0 | 7.1 | 6.5 |
| | 25 C ₄₆ H ₇₂ N ₄ O ₂ AgPF ₆ | 55 | 965.9 | 57.2 | 7.5 | 5.8 | 57.5 | 7.3 | 5.8 |
| | 26 C ₅₀ H ₈₀ N ₄ O ₂ AgPF ₆ | 55 | 1022.0 | 58.8 | 7.9 | 5.5 | 58.7 | 7.9 | 5.4 |
| III_{NO3} | 27 C ₅₄ H ₈₈ N ₄ O ₂ AgPF ₆ | 60 | 1078.2 | 60.2 | 8.2 | 5.2 | 60.0 | 8.2 | 4.8 |
| | 28 C ₄₂ H ₆₄ N ₄ O ₂ AgNO ₃ | 51 | 826.9 | 61.0 | 7.8 | 8.5 | 61.0 | 7.5 | 8.4 |
| | 29 C ₄₆ H ₇₂ N ₄ O ₂ AgNO ₃ | 53 | 883.0 | 62.6 | 8.2 | 7.9 | 62.5 | 8.1 | 8.0 |
| | 30 C ₅₀ H ₈₀ N ₄ O ₂ AgNO ₃ | 50 | 939.1 | 63.9 | 8.6 | 7.5 | 63.7 | 8.6 | 7.5 |
| IV_{BF4} | 31 C ₅₄ H ₈₈ N ₄ O ₂ AgNO ₃ | 50 | 995.2 | 65.2 | 8.9 | 7.0 | 65.0 | 8.8 | 7.0 |
| | 32 C ₂₆ H ₃₂ N ₄ O ₂ AgPO ₂ F ₂ | - | 641.4 | 48.7 | 5.0 | 8.7 | 48.8 | 5.0 | 8.8 |
| | 33 C ₄₂ H ₆₄ N ₄ O ₂ AuBF ₄ | 66 | 940.8 | 53.6 | 6.9 | 6.0 | 53.2 | 7.0 | 6.2 |
| | 34 C ₄₆ H ₇₂ N ₄ O ₂ AuBF ₄ | 67 | 996.9 | 55.4 | 7.3 | 5.6 | 55.3 | 7.1 | 5.7 |
| IV_{PF6} | 35 C ₄₂ H ₆₄ N ₄ O ₂ AuPF ₆ | 65 | 998.9 | 50.5 | 6.5 | 5.6 | 50.1 | 6.3 | 5.3 |
| | 36 C ₄₆ H ₇₂ N ₄ O ₂ AuPF ₆ | 68 | 1055.0 | 52.4 | 6.9 | 5.3 | 52.2 | 6.3 | 5.2 |
| IV_{NO3} | 37 C ₄₂ H ₆₄ N ₄ O ₂ AuNO ₃ | 68 | 916.0 | 55.1 | 7.0 | 7.6 | 54.9 | 6.9 | 7.4 |
| | 38 C ₄₆ H ₇₂ N ₄ O ₂ AuNO ₃ | 66 | 972.1 | 56.8 | 7.5 | 7.2 | 56.7 | 7.5 | 7.0 |

Figure S1: Absorption and normalized fluorescence emission spectra of compounds **1**, **5**, **13** and **15** in freshly chloroform solution at concentrations 2.84E^{-6} M (**1**), 2.51E^{-6} M (**5**), 2.08E^{-6} M (**13**) and 3.30E^{-6} M (**15**) ($\lambda_{\text{exc}} = 274$ nm; Room Temperature)

